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# SCIENCE

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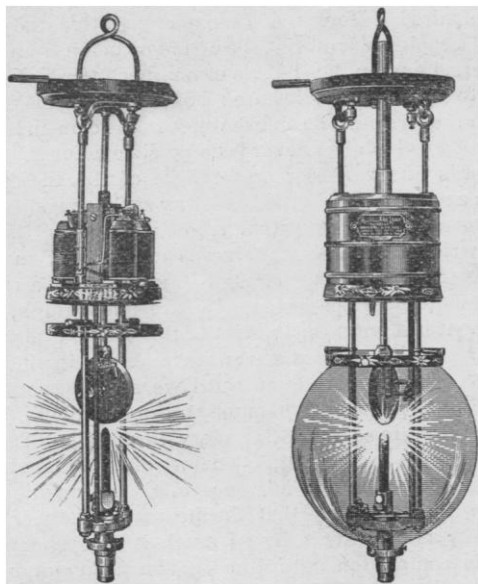
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## A SUPERIOR ARC-LAMP.

MANY efforts have been made by trained electricians and other experimenters, both in the United States and in Europe, to apply the disk carbon to the electric arc-lamp. every one appreciating how much more brilliant and lasting a light would be where the disk carbon was used rather than the ordinary pencil carbon, provided that it could be controlled. Until the present, all efforts in this direction, so far as made public, have ended in complicated and clumsy contrivances altogether unsatisfactory, and too expensive for general purposes in lighting.

The invention, of which we present illustrations, has for its object to provide an arc-lamp that will burn about twice as long without re-trimming as the arc-lamp now in general use, at a cost of constructing and operating not greater than that of the ordi-



THE RUSSELL DISK-CARBON ARC-LAMP.

nary arc-lamp. It consists in the combination of a vertically moving and intermittently rotating carbon electrode in disk form, with a pencil-shaped carbon electrode, fixed and immovable, standing vertically in the bottom of the lamp-frame. Arc-lamps as heretofore made burn about eight hours, when the carbons will be consumed; and if longer service is required, they must be renewed.

This lamp will burn and give a full light for about eighteen hours, and it may be so constructed as to burn twenty four hours before renewing the carbons. The cost of the carbons is less than the cost of those ordinarily in use in proportion to the amount of carbon in them. The electric current is less than that required by other arc lamps, as the length of carbon resistance is two inches less. The pencil being stationary, the disk is made to revolve slowly by the vibrations of the armature and the ratchet arrangement shown in the sectional view, and thus made to burn evenly around the centre. The disk descends a little lower after each rotation than it was during the previous rotation, and so on until

the disk is as nearly consumed as it may be. As the disk presents a greater surface of contact, a stronger and more steady light is secured; and over seventy per cent of the light is reflected below the disk, and not thrown above.

The lamp is provided with a device for arresting sparks, so that none can get outside the globe. It is known as the Russell electric lamp, and is attracting attention in Boston, where it is being introduced by the company controlling its manufacture.

## ON THE USE OF THE PHONOGRAPH IN THE STUDY OF THE LANGUAGES OF AMERICAN INDIANS.

THE invention by Edison of the phonograph, and the improvements in its effectiveness which rapidly followed, naturally turned attention to the possibilities which it presents in the preservation of the languages of the aborigines of the United States. It was recognized independently by several persons, that, if the instrument could be brought to a certain stage of perfection, it would serve as a valuable means for this purpose; but no one, as far as the author knows, has published an account of experiments made to test its capabilities in this direction.

In order to determine its present value for this purpose, the author undertook a series of experiments,<sup>1</sup> taking for that purpose the language of the Passamaquoddy Indians, who are the purest blooded Indians now living in the confines of New England. The result of these experiments has fully justified his expectations, and convinced him that the instrument has now reached such a degree of perfection that it can be adopted by scientific students for that purpose. He believes that it is a most valuable auxiliary in linguistic researches, and that it should be used in the study of the fast disappearing languages of races, and in making record of those which are rapidly becoming extinct.

It is thought that phonetic methods of recording Indian languages are not all that might be desired for this purpose. Even with the assistance of the admirable system of letters and conventional signs which have been proposed for that purpose, there are many difficulties besetting the path of one who would accurately record the aboriginal languages, which are but imperfectly met by this method. There are inflections, gutturals, accents, and sounds in aboriginal dialects which elude the possibilities of phonetic methods of expression. It is desirable, also, to preserve songs, sacred and secular, which are rapidly becoming extinct. Their counting-out rhymes often have inflections which are imperfectly expressed by letters. The use of the phonograph among the Passamaquoddies has convinced me that the main characteristics of their language can be recorded and permanently preserved, either for study or demonstration, with this instrument.

On a visit to Calais, Me., undertaken in March, to make experiments on the value of the instrument in recording Indian languages, many cylinders full of records were taken. These embrace a large variety of subjects, such as it was thought would represent, in a general way, the main peculiarities of this branch of the Algonquin languages. The records taken may be roughly classed as follows: 1. Songs; 2. Folk-tales; 3. Pronunciation of

<sup>1</sup> The author read a paper on this subject before the American Folk-Lore Society at its last meeting in Boston on April 19. This paper will be published later. These experiments were carried on preparatory to taking the instrument for the same purpose among the Pueblo Indians of New Mexico. The work was done under the auspices of the Hemenway expedition.

words; 4. Passamaquoddy equivalents of English words; 5. Counting-out rhymes; 6. Imitations of sounds made by animals; 7. Ordinary conversations in the Indian language, in which two or more persons took part. These records were always accompanied by a statement on the cylinder of the subject, time and place, name of the Indian giving the testimony and that of the observer. This safeguard seemed necessary for future identification, as their labels might be displaced or lost, and by that means their value be impaired.

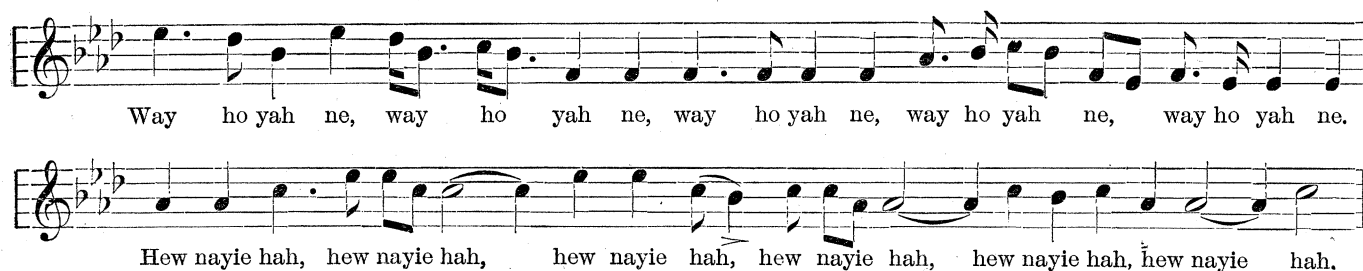
Among the songs<sup>1</sup> recorded are war-songs, a sacred song ("The Song of the Snake-Dance"), and several songs which form a part of ancient stories. It is said that in old times, as so often happens among primitive peoples, the folk-tales and legends were all sung. In many instances at the present time these stories have for the most part lost that character, and are simply narrations, although in many of them songs occur, and some still have a lyrical character. As an example of a story with songs in it, may be mentioned an interesting account of the adventures of Black Cat ("Pogump") and the Toad Woman ("Pookjinness"), a story which is full of rude imagery, in which occurs a very old song with onomatopoeic sounds. The so-called war-songs, which still survive in the memories of the old Indians, seem particularly desirable for preservation. One of these, a Mohawk war-song, the words of which were improvised, is of a most interesting character. The song sung at the celebration of the chief on the first night of the festivities was taken from the lips of the Indian who sung it the last time this event was celebrated.

Of sacred songs, the only one which was obtained is the song of the snake-dance, a little-known ceremony, which will be described in a forthcoming article in the *American Journal of Folk-Lore*. This dance, which has lost whatever sacred character it once had, has not been performed by the Passamaquoddies for five years, and the song was sung at that time by Noel Josephs, who sang it on the cylinder of the phonograph for me. All the listeners, of whom there were several, said that the song was very ancient. The words of the song as sung are as follows:—

"Way ho yāh ne, way ho yāh ne, way ho yāh ne, way ho—o—o,  
Hew nayie hah, hew nayie hah, hew nayie hah."

These words are said to be archaic, which fact is regarded as additional evidence of the great age of the song itself, and were obtained by me from a study of the cylinder of the phonograph upon which it was recorded. When compared with the original, it shows how accurate the records are. The words of the song, which have been indicated by the spelling given above, were also derived from the phonograph. They were sent to Mrs. W. Wallace Brown of Calais, Me., who is one of the best students of the Passamaquoddy language known to me; and she writes me that she regards them as indicating the pronunciation as nearly as possible by phonetic methods.

The music of the "Snake-Dance" given below was written out by Mrs. H. E. Holt. Mrs. Holt had never heard the Indians sing the song, but was able from the record to write out the notes, from which a third person sang the song in the same way as the original recorder, Noel Josephs.



The first part of the song is sung by the conjurer, who goes about with a rattle while singing, searching for the snake, keeping

<sup>1</sup> It would be desirable to apply the phonograph to the preservation of other songs which are rapidly becoming extinct. For instance, it is said that the old plantation melodies of the negroes are rapidly being replaced by other songs. These might be recorded on the phonograph for permanent preservation.

time to the music by a dance. The second is the song of the Indians who take part in forming the coil which represents the snake. Calls to those not taking part in the dance frequently occur in the second part of the song, but those are not indicated. On the same cylinder with the music of the "Snake-Dance" I was able to obtain in the Passamaquoddy language a record of the proclamation announcing the dance, and an invitation to the same.

The possibilities of the phonograph in these studies indicate one of the great advantages of this instrument. What specimens are to the naturalist in describing genera and species, or what sections are to the histologist in the study of cellular structure, the cylinders made on the phonograph are to the student of language. In the quiet of his study he can hear the song repeated over and over again as often as he wishes, and can, so to speak, analyze it, and in that way separate the constituent sounds. Moreover, these records on the cylinders can be submitted to specialists for study. The collector may not have a musical ear, as in my own case, and may not be able to write out the songs, no matter how many times they are repeated. He can in that case collect the records, and submit them at some favorable time to one who is able to catch the song and set it to music.

It is particularly desirable to record the songs of the Indians, for we may conclude that these are very ancient, and preserve their identity for a long time. This is true at least as regards those pertaining to sacred observances, which may be regarded as of great antiquity. Songs in sacred ceremonials are among the last of the religious observances to be modified or changed. Paraphernalia of sacred dances, or even the whole sacred character of the dance, may be lost; but the song would be the last to have its integrity impaired. Moreover, when a comparative study of songs of different peoples is desirable, the cylinders taken from one tribe may be carried among the Indians of another in order to compare records or to see if those taken are recognizable. This method of comparison renders possible an exactness in the comparative study of Indian songs which has never been possible before.

The records of the stories or folk-lore of the Indians which were taken can be studied in the same way as the songs. Although the cylinders remain as perpetual records of the stories, it is desirable to write out the Indian words and obtain an accurate translation. I have gone far enough in my work to see that this can be done with great precision with the phonograph, and that the instrument has great capabilities in this method of work.

The study of folk-lore can never stand on a scientific basis as far as Indian tales are concerned until we reduce to a minimum the errors of interpretation which may creep in through the translator. The tales are so full of imagery that the tendency to enlarge upon them is fascinating, and names of well-known authors who have succumbed to this influence might be mentioned. As long as there is a possibility that the hearer adds to or detracts from the story as he hears it, by so much is the value of a story for scientific comparison diminished. The phonograph records the story exactly as the Indian tells it; and although free translation of it may, and probably must, be made, to render the story comprehensible, we can always preserve the phonographic record

as a check on exaggeration, or as a reference in critical discussions of the subject-matter of the story. In this way the phonograph imparts to the study of folk-lore, as far as the aborigines are concerned, a scientific basis which it has not previously had, and makes it approximately accurate.

In order to determine the pronunciation of Passamaquoddy

words, I took on the phonograph several cylinders, with the Indian equivalent of the English words. In doing this I made use of pages of the well-known schedules published by the Bureau of Ethnology at Washington, speaking the English word, and requesting the Indian to follow with the Passamaquoddy translation. This, of course, is only possible when the Indian has a knowledge of English, or is able to know by signs what is needed.

To obtain sentences, a conversation was recorded in Indian language between two Passamaquoddies. These cylinders reveal the general linguistic peculiarities, and when studied might be valuable adjuncts in the acquirement of the language.

It seems possible that the phonograph may be found to be of valuable assistance not only in the study of Indian, but also of all modern languages. A number of cylinders with records of sentences pronounced by a Frenchman or German with the proper accent might be found a valuable aid to a teacher of these languages who is not a native of the land the language of which he is teaching. Even proficient teachers might find it a help in their classrooms. For study of these languages without the aid of a teacher, a set of cylinders with the proper pronunciation might have a great value in training the ear to the correct pronunciation of the words and sentences of a foreign language, which are but imperfectly indicated by phonetic methods. By the use of the phonograph the teacher of modern languages might be relieved of the endless repetition of pronunciation of words in a foreign language which the pupil acquires with difficulty.

I have taken the following clipping from a daily paper: "Edison's phonograph has found a new application at the Milwaukee College, where it will be used as an assistant in teaching the French and other foreign languages. The phonograph, of course, never gets tired, and can be made to repeat the same sentence or the same word hundreds of times. In giving a lesson, the teacher reads it before the phonograph, at the same time addressing the pupils, and the lesson is reproduced whenever wanted." This would seem to indicate that the use of the phonograph in the teaching of modern languages had been put in practical test.

The necessity of work with the phonograph in preserving the languages of the aborigines of this continent is imperative. There are stories, rituals, songs, even the remnant of languages which once extended over great States, which are now known only to a few persons. These persons are in some instances old men and old women, with whose death they will disappear forever from the face of the earth if some record is not now made of them. Many have already been lost forever, even in the last twenty years, and some are fated to disappear in the next decade.

These rituals are in some instances the unwritten history of the tribe, and contain all that the Indians know of their history. The younger men among several tribes do not willingly take to the customs of their fathers. They are rapidly losing their former character. They have no desire to commit to memory the rituals of their ancestors. To learn their language, to live among them and study all that pertains to them from an intimate acquaintance, even membership in the tribe, is desirable, if earnest investigators can be found to undertake it; but this is not always possible. The phonograph renders it practicable for us to indelibly fix their languages, and preserve them for future time after they become extinct or their idiom is greatly modified or wholly changed.

The prime object of the above-mentioned experiments was simply to test the capabilities of the phonograph in recording aboriginal languages. That it could be used for that purpose was assured before I began by the knowledge that it records any language with precision; so that the experiments bearing on its capabilities in this direction might seem superfluous. Demonstration, however, gave weight to belief.

The expense at the present time for the use of the instrument is possibly a practical difficulty, which it is to be hoped may be lightened for those using the instrument for scientific purposes. Certainly no idea could show a more disinterested personal interest than a wish to permanently preserve the fast vanishing languages of the American Indians. It belongs to the realm of pure science, and the scientific student will probably be met in a similar liberal spirit by those who control the patents of the phonograph.

J. WALTER FEWKES.

## FACTS ABOUT TORNADOES.

THERE is no subject in the whole science of meteorology of such absorbing interest as this of tornadoes. Its importance may be judged from the hundreds of pages that have been written upon it, from the universal attention paid it by newspapers through the length and breadth of the land, and from the fact that many insurance companies have taken the matter in hand, and are prepared to take tornado risks. It is easy to see that the interest in this topic must gradually increase as the tornado districts become more thickly populated, and as the facilities for spreading the news of disaster become greater. There is no doubt that in many instances losses from a tornado have been greatly exaggerated, and fears of devastation have been increased because pictures of the very worst tornadoes are the only ones that have been printed.

The most important thing for us to do is to establish the facts, and these will serve as a basis from which we may uproot false theories, and, if not now, at some time in the future, to build up a solid superstructure. It is to be noted that all studies on this question ultimately turn to the facts, either to support theories or to form them. We shall find the most diverse views in these discussions, and yet every one of them based upon facts. It is only because of a false or imperfect interpretation of what is observed that such antagonism can exist. A partial explanation of these conflicting views lies in the fact that the outburst of a tornado is accompanied by such terrifying manifestations, and observers are in such fear for their lives that they are totally unfitted to give an account of what they have seen. In many cases, also, there has been altogether too narrow a view taken of this phenomenon. We have been entirely absorbed in the immediate destruction, the demolition of houses, the twisting-off of trees, the distribution of *débris*, etc., and have neglected the atmospheric conditions which have led up to the disaster. All will agree that a thorough knowledge of all the circumstances attending these outbursts is indispensable, if we would learn the mechanism of a tornado, or if we ever attempt to guard against its devastation, or ever try to give warning so that others may protect themselves. We may enumerate some of the facts as follows:—

### Quiescent State of the Atmosphere.

It is quite well known that tornadoes seldom occur singly, but many are formed over an extended region, five hundred or more miles in length and breadth, where the conditions are favorable for their development. In this region the air is remarkably quiet previous to the tornado. There is a general or wide-extended storm some two hundred or four hundred miles to the north-westward; and into this storm, which is usually intensified much above the average storms at that season, gentle southerly and south-easterly winds are blowing at a distance, which are freshened as the centre is approached. Tornadoes rarely occur in any but the hotter season, say from April to August; and in this season, even when there are thunder-storms, high winds are an exception.

### Temperature.

The universal testimony is, that there is an exceedingly warm and sultry air. Even if the sky be overcast, and the